8 February 1965

In reply refer to
Ltr. No. 65-50,241

Electronics Research Center
575 Technology Square
Cambridge, Massachusetts, 02139

Attention: Mr. John Sullivan

Subject: Contract NAS8-903, Monthly Letter Report

Enclosures: Two (2) Copies of Subject Report

Gentlemen:

The attached monthly letter report is provided and distribution has been made in accordance with Article X B of the subject contract.

If there are any questions, do not hesitate to contact the undersigned at mail point 174 or extension 3139.

Yours very truly,

[redacted]
A Division of
Martin-Marietta Corporation

[redacted]
Special Projects
Contracts Administrator

/xx

CC: Capt. P. [redacted]
U.S. Army Missile Command
Orlando Branch Office (C/O Tmcl.)

Enclosure # 1
Ltr. No. 65-50,241

Investigation of the Propagation of Millimeter
and Submillimeter Waves
Contract No. NASw-963
Monthly Letter Report
Period: 1 January to 31 January 1965

Harmonic generation has been employed to obtain energy in the 170 gc to 180 gc region. The phase locked system was used to display the derivative of the interferometer response on a recorder using a 0.1 second integration time. Response asymmetries made the validity of Q measurements by this method questionable. Subsequent investigation revealed the necessity for tuning the open waveguide coupling apertures with respect to the flat mirror surface. Base line distortions were encountered and were removed by lining the vacuum chamber with absorbing material. As a result of these efforts, a symmetrical, undistorted response was achieved. In addition, the signal to noise ratio was sufficiently improved to warrant an attempt to measure loss by noting the reduction in transmission coefficient at resonance as given by the relationship:

$$\alpha = \frac{2\pi}{\lambda Q_o}\left[(d_o/d_1)^{1/2} - 1 \right].$$

In this expression for power loss, the output power ratio d_o/d_1 is measured by maintaining a constant interferometer output with a linear helipot inserted between the oscilloscope display and the interferometer output. The output display is obtained by sweeping the klystron from which 174 gc is obtained by multiplication.

Initial loss measurements were in basic agreement with absorption data predicted by Van Vleck's relationship for water vapor and Rosenblum's published data for atmospheric absorption. Determination of line width (183 gc) parameters for self broadening of H_2O and for collision broadening by nitrogen are now in progress.

Amplitude and loss measurements can be obtained to an accuracy of less than 1 percent using this technique.

Molecule constants of water as predicted by Benedict (Reference 1) have been found to be the most reliable for predicting the general region in which to find water vapor lines. To date, absorption cell measurements have located lines near 325, 380 and 448 gc. Stark effect measurements will be continued on these lines during the next report period.

151.6 manhours were worked during the report period.

V. E. Derr
Principal Researcher

A. H. Ryan, Manager
Physical Sciences Laboratory

Reference 1 - Benedict, Claassen and Shaw, J. Res., NBS, 19, 91(1952)